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ABSTRACT

The technology teaching lab program at Ohio State University at Mansfield is a series of 2-hour labs that runs concurrently with preservice methods blocks. The purpose of the lab is to give the students the experience necessary to integrate technology into their classroom. The lab provides the students with instruction, opportunities, and equipment to take their technology-enhanced lessons directly to the field. This research found that given time, technology, assistance, and experience, students could create technology-enhanced lessons. The implementation of the technology teaching lab, connected with the profile template, provides preservice teachers with the structure and opportunities to meet the profile goals set by ISTE (International Society for Technology in Education). Finally, the technology teaching lab and the accompanying template provides opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations. (Author/AEF)

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The Technology Teaching Lab: Meeting the ISTE Standards

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Abstract

The technology teaching lab program is a series of 2-hour labs that runs concurrently with preservice methods blocks. The purpose of the lab is to give the students the experiences necessary to integrate technology into their classroom. The lab provides the students with instruction, opportunities, and equipment to take their technology-enhanced lessons directly to the field.

This research found that given time, technology, assistance, and experience, students could create technology-enhanced lessons. The implementation of the technology teaching lab, connected with the profile template, provides preservice teachers with the structure and opportunities to meet the profile goals set by ISTE. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

Problem

According to the U.S. Department of Education, only 20% of the 2.5 million teachers currently working in our public schools feel comfortable using the technologies available to them (NCES, 1999). This is a tragedy, but one that is remedied by providing students with a true working knowledge of current educational technologies and opportunities and experiences to integrate those technologies into their classrooms. Many colleges of education have found ways to increase students' knowledge of technology through independent courses. It is reported by the Office of Technology Assessment (1995) that much of technology instruction is related to the teaching of technology instead of teaching with technology to enrich curriculum (Duhaney, 2001). Nevertheless, institutions should teach teachers how to use technology to support multiple content curriculums (Ingram, 1994). Unfortunately, there has been little done in the area of experiences of technologies in the classrooms. Because of the importance of experiences with technology in the field, it is the goal of many departments of education to include clinical experiences (Duffield, 1997).

Currently, the education department at Ohio State University at Mansfield is trying to incorporate technology into our courses by giving assignments that encourage the use of technology. Unfortunately, there is no time given to students to experiment or develop the technology-enhanced lessons. The methods courses are full of methods content. Nevertheless, it is vital to give students experiences both in teaching with technology and participating as a student using technology (Cuba, 1995). Because of this, our department makes every attempt to enhance our teaching with technology. This happens through required presentations, including the input of digital images, expectations of technology for required lesson development and assessments, the use of digital picture displays to enhance an activity, and the use of Web CT. Through the development of these and other uses of technology in our methods courses, we are beginning to give our students experiences from a student perspective. In addition to this, though, there must be a teaching component to technology experiences. This happens with the development of the technology teaching lab.

Research Questions

This is a qualitative ethnographic study in case format as defined by Guba and Lincoln (1994). It is because of this methodology that issues of description and interpretation are of utmost concern. The questions informing the interpretation of data in this study have the following foci:

- Determine whether a student can or cannot reach the expectations of the ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab.
- Determine types of technology infusion used to meet these standards.
- Determine the perceived ability of the students following the technology teaching lab.

The Technology Teaching Lab

Before the Technology Teaching Lab, if a student wished to use technology in her field placement Ohio State University at Mansfield, not only did she have to plan, create, and write the lesson in her own time in addition to the other lessons from the content areas, but she had to depend on the technologies of the school in which she is placed. Often times, the schools would have little equipment or equipment that is not compatible with the developed lesson.

The Lab Course

The goal for this program is to increase the use of technology in our students' lessons in ways that will enhance their teaching. The purpose of this lab is to provide the preservice teachers in our elementary education program opportunities and assistance in creating and using technology-enhanced lessons into their field placements. The Technology Teaching Lab component is a 2-credit course scheduled for two quarters to run simultaneously with our methods blocks. Connections and

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constructivist theory are two foundations to our program. Any new addition to our program needed to address both core areas. Because of our strong commitment to the integrated approach to teaching, our technology component needed to connect to our methods blocks. Our methods blocks run in two consecutive quarters to include a methods course from social studies, math, language arts, and science. We addressed the issue of connection by including requirements for technology-enhanced lessons in each of our syllabi. Within each content area, there are expectations for lesson development and integration within those lessons. We expect our students to write their lessons in a unit: integrating content as much as possible, when there is a natural fit. By connecting the technology teaching lab with the content methods courses, we provide our students with multiple ways to integrate technology into each content area and thus integrate the content areas through technology. Each methods course has an expectation of technology integration into the lessons.

The lab course meets once every week during the same quarters as our methods block for a two-hour period. There are two time slots available to better meet the needs of the students: one after school on class days and one after school on their field placement days. In addition, the lab space is available for walk-ins throughout the week. The students work during this time to create technology-enhanced lessons that they will take directly to their field placement. There is little direct instruction; instead, time is spent on the uses of instructional technologies, demonstrations of those uses, and play with the equipment. The primary structure of the lab course is open and one of discovery and experience. Students are to play and create lessons, again, to take directly to the field.

Students write technology-enhanced lessons and use educational technology in their field placements. This important facet (that of experience) of the lab course gives students the practice in developing and revising educationally sound, technology-enhanced lessons for their future classrooms. The lab provides students supervised time to experiment with the hardware and software to create technology-enhanced lessons that connect to the requirements of the methods courses. These technology-enhanced lessons incorporate imaging, Internet use, and presentation tools. Then, the students take the created lessons directly to the field.

The Lab Instructor

We addressed our other area of focus, constructivist-learning philosophies, through the format of the lab course. The natural starting point for instruction in a constructivist classroom is not the material to be taught, but student interests, prior experiences, and current understandings (Ravitz, Becker, & Wong, 2000). Because of this, a true constructivist form of a Technology Teaching Lab would have to accommodate for a variety of levels of technology abilities in the students and provide for their varying interests. We designed the Technology Teaching Lab course to be one of discovery and experience. The purpose of the lab is to provide our students with the opportunities to develop appropriate uses of the technologies in their field placements and to then take those lessons directly to the field, giving the students the experiences necessary to integrate technology into their classroom.

The teacher's role in a constructivist setting is to facilitate student-designed efforts. This instructor is also available in the physical space of the lab to assist students. The major focus of the instructor's time is on play and on emergent needs of particular lesson creations. The instructor's responsibility is to help the students develop educationally sound applications of technology in their field placement in close connection to the education department and the needs and requirements of the methods courses. The instructor is also available in the physical space of the lab to assist students.

Equipment

We purchased a variety of technology tools that our students could take directly to their field placements. These tools included: portable laptop and projector sets, flex cams, digital microscopes, computer calculator sets, a variety of canned software, digital cameras, and digital video cameras. By providing the students with the equipment, the students can create a lesson and deliver the lesson directly without concern for lack of hardware, software, or hardware mismatches.

The Assessment tool

As a department, we have adopted the ISTE standards (International Society for Technology in Education, 2000) for technology in preservice education. As an evaluation piece, I created a template out of those competencies specifically set to the professional preparation performance profile created for pre-service teachers to be completed before their internship experience (ISTE, 2000). Each of our students downloaded this template, the profile in table form, onto a zip disc. Our students wrote a short narrative addressing how they hit each of the competencies and included with this narrative a hyperlink to electronic evidence of their work. This evidence could be in a variety of forms. For example, if a student wanted to demonstrate that she wrote and taught a lesson using Hyper Studio, she might use two forms of evidence. First, she might hyperlink the lesson portion to her actual text document write-up of the lesson. Second, she might hyperlink her teaching evidence to an example of a student's presentation. In doing this, the student has demonstrated her capabilities to write and teach a technologically enhanced lesson, and demonstrated her ability to use technology as a form of self-evaluation. She is documenting her technology use and at a future time, can reflect on that use and revise and recreate. Another example might be that of email threaded discussions maintained throughout a field assignment. The student teacher could simply retain a copy of the discussions and hyperlink them to the template to use as electronic documentation. A sample portion of template is provided in table 1.

Table 1. Template Sample

Prior to the culminating student teaching or internship experience		
Technology Operations and Concepts		
	Task	**Electronic Evidence**
Examine technology tools used to collect, analyze, interpret, represent, and communicate student performance data.	"Free online grade book software."	http://www.classbuilder.com
Planning and Designing Learning Environments and Experiences		
Identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction.	"Taught an integrated lesson which included an Excel graphing exercise in the computer lab. Twenty-three students in class."	bellvillelesson17.doc
Design and teach technology-enriched learning activities that connect content standards with student technology standards and meet the divers needs of students.	"An example of a student-produced graph from an integrated technology lesson I taught in the computer lab at Bellville Elementary."	**Cody.xls**
Teaching, Learning, and the Curriculum		
Apply on-line and other technology resources to support problem solving and related decision making for maximum student learning.	"Incorporate higher-level thinking problems and questions with NCTM math-related activities."	http://standards.nctm.org/document/eexamples/index.htm
Productivity and Professional Practice		
Identify and engage in technology-based opportunities for professional education and lifelong learning, including the use of distance learning.	"Opportunities for professional development and resources."	http://www.nctm.org http://www.ohioschoolnet.k12.oh.us/
Social, Ethical, Legal, and Human Issues		
Identify issues related to equitable access to technology in school, community, and home environments.	"Equity project WI '01"	**EquityWI01.ppt**

Methodology

Purpose of Study

The purpose of this study is multifaceted: first, to determine whether or not students can meet the expectations of the professional preparation standards set by the ISTE standards can be met by the implementation of the technology teaching lab and second, to determine what level of technology infusion students choose to use in meeting these standards and finally to guide development of the technology teaching lab. The results of this study will be beneficial to other departments of education in their drive to meet national standards and infuse technology into their programs.

Design, Instrumentation, and Data Analysis

The design of this study utilized qualitative research methods from the interpretivist paradigm (Guba & Lincoln, 1994). This is a case-study to represent a molar unit, a multiple of individuals (preservice teachers). The use of a molar unit in this case is to extend external validity of results (Huberman & Miles, 1994). The case format is not one of generlizability; it instead has a focus of transferability. This transfer is to similar sets of participants. Data were gathered from multiple sources during the 2000-2001 school year.

The data was collected in two formats. First, the ISTE profile template (as defined previously as the tool for the course). The data from the template was inserted into a database for ease of analysis. The database was analyzed in a variety of manners. First, the database was used to determine what the students used as an electronic example for their meeting a particular standard. Second, the variety of evidence used to document to student's meeting the standards. Finally, the database was used to interpret the level of technology infusion.

In addition to the database, a survey was distributed at the end of the second quarter in which the students took the lab. This survey asked questions about the student's perceptions of their technology abilities, their anticipated use of technology in the classroom, and their impressions of the technology teaching lab. Open-ended comments listing strengths and concerns were coded by emergent topics. A cluster method of data analysis was used throughout the interpretation of data (Huberman & Miles, 1994).

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Description of site and participants

This study took place at a regional campus of a large, mid-west University. The participants for this study were 21 Masters of Education students. Their ages ranged from 23-43, four male; 17 female, 20 Caucasian; 1 Asian-American, and from middle-class background. Students came to the masters degree certification program with a variety of undergraduate degrees: elementary education, psychology, law, the ministry, and private business. All students were required to take the 2-credit hour technology teaching lab course with each of their methods block quarters (totaling 4 credit hours). This was the first year of this requirement.

Results

Demonstration of Technology Use

At the end of the second lab course, students completed their templates with a narrative stating how they met each standard and a hyperlink connecting to a piece of electronic evidence that supported their statement. Table 2 shows the distribution of electronic evidence used by the students in their templates. The data is heavy in the areas of web sites and presentations. The use of web sites was intriguing and warranted further investigation into the manner by which they used the sites as documentation of meeting a particular standard. The manner in which the sites were used in denoted in the second category of results, level of evidence. The use of presentations as a demonstration of evidence stems from the assignments given in the methods block courses. In the 2002-2001 school year, the year of this study, the students were required to produce a presentation in the math and science methods block courses in which they took digital video of an integrated lesson, imported portions of their video into a power point presentation, and reflected upon the concerns and strengths of the lesson. This project was called the MST project and each student created two presentations in this format; one in the first methods block and another in the second methods block.

Table 2. Evidence Used

	Web Sites	Documents	Excel	Presentations	Other
Technology Operations and Concepts	19	1	1	1	18
Planning and Designing Learning Environments and Experiences	40	22	2	71	3
Teaching, Learning, and the Curriculum	48	11		1	
Assessment and Evaluation	48			20	10
Productivity and Professional Practice	20	4	2	14	
Social, Ethical, Legal, and Human Issues	92			2	2
Total	**267**	**38**	**5**	**109**	**33**
Percentage of profile standards met	**59%**	**9%**	**1%**	**24%**	**7%**

Level of Technology Evidence

In addition to the types of technology used by the students as evidence of meeting the profile, the data was analyzed for level of technology integration. In this analysis, a clustering and coding method was implemented. This coding produced three major categories of technology infusing: teacher-centered technology, child-centered technology, and task-centered technology. Teacher-centered technology refers to technology used by the teacher but in the context of a lesson. In this case, the teacher is the worker. It would be similar to the teacher using technology to enhance a lesson that would otherwise be teacher directed. An example of teacher-centered technology would be a teacher-created presentation using power point or Hyperstudio to demonstrate the development of a seed. Another example of teacher-center technology would be a class-created excel chart in which the teacher input the data on a centered machine that is connected to a projector or large screen television. Another example of a teacher-center use would be the teacher using some sort of project device to demonstrate the components of a seed using a flex cam. Still another example of a teacher-center infusion would be a class game using a canned CD and a projection device.

The second category for technology infusion determined by analyzing the data from the templates is child-centered technology. This format refers to technology used by the children in the class, either in small groups or individually. In this case, the child is the worker. This would be similar to the teacher using technology to enhance a small group task or individual seat work assignment. An example of child-centered technology would be child creating a publishing document that focused on a particular country to be used as an assessment in a class. Another example of this format would be a group of students creating a presentation documenting the recycling of garbage. Another form of child-centered technology would be a student writing a story and importing still photos to illustrate the story. Still another form of child-centered technology would be the use of Internet interactive tools with each child at a computer station (ex. E-examples from NCTM).

The third category for technology infusion determined by the template is task-center technology. This format refers to technology used by the teacher in the design of a lesson, a class, or profession growth or organization. In this case, the task is the focus with the teacher as the worker. This would be aligned to traditional preparation and paperwork connected to the profession of teaching. An example of task-centered technology would be a web site used to obtain information about a lesson on the circulatory system. Another example would be the creation of an excel chart or word "chat" or email format that demonstrated

collaboration on issues of teaching. Still another example would the completion of an assignment for a course in education (in document, sheet, or presentation format).

Table 3 indicates the various forms of technology evidence used by the preservice teachers to demonstrate competence in the performance indicators. Special note is made to the performance indicator goal, which in many cases does not require lesson development, but rather technology use in the profession of teaching.

Table 3. Narrative Coding

	Teacher-center technology	**Child-centered technology**	**Task-centered technology**
Technology Operations and Concepts	0	0	54 (100%)
Planning and Designing Learning Environments and Experiences	12 (7%)	67 (38%)	96 (55%)
Teaching, Learning, and the Curriculum	0	4 (6%)	60 (94%)
Assessment and Evaluation	1 (1%)	12 (12%)	87 (87%)
Productivity and Professional Practice	0	0	43 (100%)
Social, Ethical, Legal, and Human Issues	0	0	104 (100%)
Total	**13**	**83**	**444**
Percentage of profile	**3%**	**15%**	**82%**

Student Perceptions

Secondary to the template, was the survey. This survey was administered for the purposes of course development. Nevertheless, the survey indicates a level of ability and comfort that could inform other institutions where technology infusion programs are being developed and under consideration. Table 4 indicates the technologies that student would most likely use in their teaching. This reflects technologies that were emphasized during the technology teaching lab and those technologies that were demonstrated during the technology teaching lab.

Table 4. Technology most-likely to use in teaching

Hardware	Raw score*	**Rank**	Raw score*	Software
Digital camera	26	1	22	Word processing
Flatbed scanner	57	2	43	Internet
Digital video camera	64	3	75	Power point
Flex cam	71	4	83	Hyperstudio
Multimedia projector	94	5	93	Educational programs
Dissecting microscope	100	6	104	Spreadsheet
Digital balance	113	7	111	Database

* Combined rating of 20 students with a rating of 1 as most likely.

Student Perceptions of Technology Teaching Lab

An open-ended comment section of the survey revealed what the students thought were concerns and strengths of the technology teaching lab. These concerns could be categorized into three subheadings: Instructor, time, technology, and ability. Interestingly, the instructor and ability were indicated and coded as major categories for both the concerns and the strengths of the technology teaching lab. The instructor was commended on several surveys for being available, experienced, and flexible. An example of this was, "Instructor was flexible, helpful, patient, personable, kept the class 'real'". Alternatively, the instructor was also listed as a concern for a lack of expertness, and not conducting the class on an individual level. Ability was an indicator of strength; "Class is needed, gained an enormous amount, a lot further in my ability to use technology, I learned a lot, I feel capable," and a concern; "...overkill, quite comfortable previous to this class, lab times inconvenient, class needs to be 'stepped up', should have been much more help, start classes in fall, need better connection to methods courses."

One of the categories that did not show through in both strengths and concerns was that of time. Time was indicated as a strength because students felt that they were given an extended period of time to actually write technology-enhanced lessons; "...lots of time to work on our technology components of projects, more time to use technology to plan lessons." Technology was listed as a concern, as it often is in the cases of infusing technology into the classroom; "...technology fail (ures), better connection to printer, (need) better equipment"

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Discussion

The technology teaching lab, while still in its infancy, shows great promise. It provided a venue for preservice teachers to address issues of technology connected to their field placements and to their classroom assignments. It demonstrated a connection to the questions stated earlier in this writing.

The Technology Teaching Lab and the ISTE Standards

It follows that students can meet the profile set by ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab and courses similar in focus. The students used a variety of electronic evidence but the primary tool was that of web sites. At first glance, this might be disturbing. However, this indicates that students find the tool of the computer useful in the research and information gathering aspect of teaching and learning. When reading the data, it was necessary to realize that the ISTE profile contains six categories: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. The majority of the six categories focus on technology issues and not technology as a tool of instruction. Under the heading of Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, and Assessment and Evaluation, it would be reasonable to find students using a variety of electronic evidence indicators. It may be advantageous for instructors to suggest types of evidence that would meet particular goals, but I hesitate to say this in light of the focus of constructive methods for the class. By suggesting a specific piece of evidence, it may limit the preservice teacher's creative role in this venture. Still, a wider variety of evidential components would be preferable.

Technology Infusion: Types and Level

By categorizing the evidential narratives given by the students, it was clear that there are three major roles of technology in preservice teacher education: teach-center technology, child-centered technology, and task-center technology. Again, looking at the profile stated, the issues that students needed to address were various. Many students met professional profile expectations using appropriate manners. The students who used child-center technology used it under headings were that was appropriate: Planning and Designing Learning Environments and Experiences and Assessment and Evaluation. Again, at first glance, one might wish to see more teacher-centered and child-center technologies indicated in the narrative section of the template. However, the fact that the students used a variety of teacher, child, and task centered activities is encouraging. It is vital to use a variety of methods of technology infusion into teaching. Just as it is vital to use a variety of teaching methods in teaching. The fact that the preservice teachers used many task-centered narratives indicates the
place they are in their program (using technology to complete assignment tasks) and their developmental stage in teaching (initial play and discovery).

Student Perceptions

It is reasonable for the students to wish to use technologies in their teaching that they have familiarity with and that they have had success with in the past. This is clear in their indication that word processing, digital cameras, and presentations would be of interest to them in their teaching. The students in this program were expected to use these technologies throughout the methods blocks and chose to use them in their field placements. They are very familiar with presentation software through class assignment in their methods blocks. It is a goal to get them to feel more comfortable with the uses of other technologies: flex cams, computer calculators, digital imaging, and projection devises. This will happen through the emphasis of these technologies in their methods blocks to give them the student perspective. This experience then will give students a feeling of comfort and success that they can then transfer to their teaching. It is also vital for preservice teachers to see how professors use technology to enhance their teaching. Through this, the process of teaching with technology is modeled and can then be applied to their teaching.

Modifications for the Technology Teaching Lab

There are a few considerations to make to modify the technology teaching lab to better meet the needs of students and the expectations of the ISTE standards. One issue that arose through the data was that of instructor. While the original intend of the technology teaching lab was to create a block of time where students could play and invent, the instructor relied on a more instruction-based format. This created problems for students who felt that they did not need the instructional time on particular technologies and for the students whom desperately need the "play" time to accommodate their learning style. The instructor has since modified his instructional method to better meet the constructivist, discovery format and preliminary lesson submissions from the current cohort of students shows an increase in technology infused lessons. This demonstrates a need for a particular teacher and learner paradigm distinction to best accommodate the technology teaching lab and its intent to foster technology-infused lesson development in preservice teachers' lessons.

Another aspect of modification is that of classroom experience. Our students are benefiting from an increased role of technology in their methods block course. This increase gives the students opportunities to see technology used in instruction from a students' perspective. Some of the additional and continuing aspects of technology infusing in the methods courses

include: Computer Poster Sessions, Computer Calculators, Flex Cam and GPS demonstrations, electronic backyard History Projects, Integrated Assignments including the MST Projects (Math/Science), Equity Project (Math/Social Studies), and Drama Display (Math/Language Arts).

Finally, the modification connected to the particular technologies used in the methods blocks and in the technology teaching lab need to be consistently revisited. Technologies available to teachers in the schools are ever-changing and need continual modifications.

Consideration for future research

Currently, students in the preservice program are required to take an inventory of abilities and experiences connected with the ISTE profile. Students take a 2-part survey in which they self-report experiences with technologies and ability with technologies connected to the profile subsections: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. This survey will demonstrate growth incurred by the implementation of the technology teaching lab. Additional data is also being collected for future research connected with the students' lesson plans. Future research will not only use data from the template and the survey, but also coding from the submitted lessons and lesson reflections that include technology as a component.

It would be a benefit to this research and to research on technology in teacher education in general if follow-up studies were conducted to connect preservice teachers' indications of use with actual use, observed and reported after the teachers are employed full-time. Such research would add to the field of technology infusion in teacher education.

Conclusion

In conclusion, this report finds that given time, technology, assistance, and experience, students can and will create technology-enhanced lessons. These experiences of creating and field-testing lessons with the assistance of technology or with the inclusion of technology will aid students in the task of meeting the ISTE professional preparation performance profile. The technology teaching lab is one option for providing such qualities to a preservice education program. In addition, the template used throughout this program is a valuable tool for departments to use when evaluating program and providing evidence for current and future grants. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

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